PATENT ABSTRACTS OF JAPAN

(11)Publication number : 03-065659

(43)Date of publication of application : 20.03.1991

(51)Int.Cl. G01R 1/073
G01R 31/26
H01L 21/66

(21)Application number : 01-202081

(22)Date of filing : 02.08.1989

(71)Applicant : TAKEDA SANGYO KK

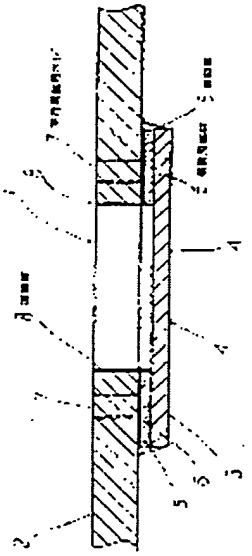
(72)Inventor : BANDO KENJIRO

(54) PROBE CARD

(57)Abstract:

PURPOSE: To reduce the contact pressure of a wafer chip to a pad thereby preventing the pad from being damaged by providing, in place of a contact needle, a bump having a circuit printed on a transparent plate.

CONSTITUTION: Bumps 4, 4 are pressed in contact with a pad of a wafer chip from above. At this time, the grounding state is monitored through a transparent plate 3 from a central hole 1 of a card substrate 2. If the pad and pumps 4, 4 are not in uniform contact with each other, they are adjusted by parallel adjusting screws 7, 7. After the pad and bumps 4, 4 are adjusted in uniform contact visually, a high frequency wave is applied to a vibrating plate 8, causing vibration of the plate. Then, electric characteristic test is conducted. The vibration of the plate 8 is transmitted to the transparent plate 3 itself, and the bumps 4, 4 are eventually vibrated. Since an oxide film formed on the pad is slightly delaminated by the vibration of the bumps 4, 4, conductive property is enhanced, enabling favorable electric characteristic test.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of

rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

(citation 9)

Japanese Patent Laying-Open Publication No. H3-65,659
Publication Date: March 20, 1991
Application No. H1-202,081 filed August 2, 1989
Inventor: Kenjiro BANDO
Applicant: Takeda Sangyo K.K.

Title of the invention: Probe card

(Claim)

A probe card characterized by comprising a card board (2) having connectors (b) attachable and detachable to and from a tester (c), a central aperture (1) formed through the card board, a transparent board (3) covering said central aperture from the bottom of said card board, an auxiliary plate (5) and a cushion member (6) of rubber disposed between said card board and said transparent board, parallelism adjusting screws (7) arranged about the periphery of said central aperture and having tip ends for making pressure contact with said auxiliary board, bumps (4) disposed on the lower surface of said transparent board and arranged to correspond with pads of a wafer chip and means (8) for vibrating said bumps.

(Abridgment of the description)

Referring to Fig. 3, a probe card 2 has a central aperture 1 and a transparent board 3 disposed below the central aperture 1. A plurality of bumps 4 are disposed on the lower surface of the transparent board 3. The transparent board 3 is attached to the lower surface of the probe card 2 via an auxiliary plate 5 and a cushion pad 6, and adjusting screws 7 are arranged in the probe card 2 about the central aperture 1. In use, the probe card 2 is placed on a wafer chip and observation is made through the transparent board 3 to see if the bumps 4 are in contact with corresponding pads of the wafer chip. One or more of the adjusting screws 7 are operated to adjust the orientation of the transparent board 3. A vibration board 8 is provided for vibrating the bumps 4 so that they can scratch away an oxide layer overlaying contact pads of a wafer chip.

(19) Japanese Patent Office (JP) (11) Patent Laid-Open
(12) Publication of Patent Laid-Open (A) No. Hei 3-65659

(51) Int.Cl.[5]	ID Symbol	Internal Ref. #	(43) Laid-Open March 20, Heisei 3 (1991)
G 01 R 1/073	E	6723-2G	
31/26	J	8203-2G	
H 01 L 21/66	B	7013-5F	

Examination Requested # of Claims 1 (Total 5 pages)

(54) Title of Invention PROBE CARD
(21) Patent Application No. Hei 1-202081
(22) Application Filed on August 2, Heisei 1 (1989)
(72) Inventor Kenjiro BANDO c/o Takeda Sangyo K.K., 2781 Oaza Nakahara, Kasuya-cho, Kasuya-gun, Fukuoka
(71) Applicant Takeda Sangyo K.K. 2781 Oaza Nakahara, Kasuya-cho, Kasuya-gun, Fukuoka
(74) Attorney Noriharu ARIYOSHI, patent attorney

SPECIFICATION

1. Title of Invention
Probe Card

2. Claim
1. A probe card characterized by comprising, a card substrate provided with a connector attachable to and detachable from a tester, a central aperture formed approximately centrally through said card substrate, a transparent plate of a dielectric material for covering said central aperture from the lower surface side of said card substrate, an auxiliary plate and a cushion member of a modified rubber or the like disposed between said card substrate and said transparent plate when mounting the latter to cover said central aperture, parallelism adjusting screws arranged about the periphery of said central aperture and having tip ends capable of making pressure contacts against said auxiliary plate and bumps disposed on the lower surface of said transparent plate and wired to correspond to pads of a wafer chip, the probe card further comprising means for imparting vibrations to said bumps.

3. Detailed Description of Invention
<Field of Industrial Applicability>
The present invention relates to a probe card for conducting electric measurements on a semiconductor chip having a multitude of pins. The probe card utilizes contacts through bumps, rather than styluses for making electric measurements.

<Prior Art>
Semiconductor products are tested for electric characteristics, such as electric continuity, when they are fabricated. For example, semiconductor products are tested while they are resident on a wafer, and electric tests are also made on various integrated circuits including resistor arrays, diode arrays and liquid crystal displays.

A probe card is a known measuring device having a card-like configuration, and is used exclusively for each kind of semiconductor product. An example is shown in Fig. 5, wherein a card substrate A is connected, through a connector B coupled thereto, to a tester C.

A plurality of styluses D are disposed at a central region of the card substrate A, and the tip ends of the styluses D are configured to project downwardly.

On the other hand, semiconductor wafer chips E are located at predetermined positions on a moveable pedestal F, and the moveable pedestal F is moved to successively locate the wafer chips E in a position below the styluses D. The wafer chip E is then electrically measured with the styluses D.

The styluses D mounted on said card substrate A are attached to the card substrate A through a dielectric material G, such as epoxy resin or the like, as shown in Fig. 6, so as to correspond to a number of pads on the wafer chip E.

<Problems to be Solved by Invention>

In recent years, however, due to the popularity of VTR machines with liquid crystal displays, word processing machines and the like, the demand for highly integrated circuits (multi-pin circuits) is increasing. To keep up with this trend, there may be no other way than to increase the number of styluses. However, the fact that the stylus is of a 200 to 250 micrometers thick has posed a limit in arranging the styluses in a highly dense manner. Further, the styluses are readily susceptible to misalignment as the density increases. Also, problems such as bending of the styluses and short circuiting among the styluses are likely to occur. Moreover, as it is necessary to have only the tip ends of the styluses contact with the pads on the wafer chip, there are actually many such instances where the pads are pierced and damaged by the tip ends when the contact forces are adjusted improperly.

To solve the above problems, the present invention aims to provide a probe card which does not use the styluses but which utilizes a group of bumps arranged on a dielectric board such as a glass plate for making contacts with the pads on the wafer chip.

<Means for Solving the Problems>

The above object of the present invention can be achieved with a probe card having the following construction. Namely, the gist of the present invention resides in a probe card characterized by comprising, a card substrate provided with a connector attachable to and detachable from a tester, a central aperture formed approximately centrally through said card substrate, a transparent plate of a dielectric material for covering said central aperture from the lower surface side of said card substrate, an auxiliary plate and a cushion member of a modified rubber or the like disposed between said card substrate and said transparent plate when mounting the latter to cover said central aperture, parallelism adjusting screws arranged about the periphery of said central aperture and having tip ends capable of making pressure contacts against said auxiliary plate, and bumps disposed on the lower surface of said transparent plate and wired to correspond to pads of a wafer chip, the probe card further comprising means for imparting vibrations to said bumps.

<Working Example and Function>

A probe card in accordance with the present invention will now be explained in detail with reference to the drawing figures illustrating a working example of the same.

Fig. 1 is a side explanatory view of a probe card A in accordance with the present

invention and Fig. 2 is a plan explanatory view of the same.

The probe card A comprises a card substrate (2) of epoxy resin or the like and having a central aperture (1) centrally formed therethrough, a transparent plate (3) of quartz glass or the like disposed to cover the central aperture (1) and a group of bumps (4) printed and wired on the surface of the transparent plate (3). Then, as shown in Fig. 3, the transparent plate (3) is attached to the lower surface of the card substrate (2) through an auxiliary plate (5) and a cushion member (6) of a modified rubber or the like, and parallelism adjusting screws (7), (7), ... are arranged in the card substrate (2) on the auxiliary plate (5) with their tip ends abutting against the auxiliary plate (5). Clockwise or counterclockwise rotation of the parallelism adjusting screws (7) urges the tip ends to abut against the auxiliary plate (5) and, due to the degree of rotation the transparent plate (3) can be adjusted for parallelism through the cushion member (6). Further, a vibration plate (8) having an end abutting against the transparent plate (3) is mounted on the inner wall of the central aperture (1).

Then, as shown in Fig. 4, the transparent plate (3) is formed with channels, i.e., electric conduction paths (9), (9), ... for a power circuit on the lower surface of the transparent plate (3) through a thin-film hybrid IC process. At the distal ends of the electric conduction paths (9), (9), ..., bumps (4), (4), ... are formed to protrude at such positions that correspond to the positions of pads on a wafer chip. The bumps (4) are formed with a material having excellent conductivity and wear-resistance.

Further, the proximal ends (10) of the electric conduction paths (9) formed on the transparent plate (3) are integrally connected to a pattern (not shown) wired on the lower surface of the card substrate (2).

It is added that the material for the transparent plate (3) is not limited to quartz glass. It can also be any other hard and transparent material having excellent dielectric property, such as white sapphire glass or the like. A material which can be formed into as thin a plate as possible is desirable.

Furthermore, other than the above mechanism in which the vibration plate (8) is vibrated to impart vibrations to the bumps (4) through the transparent plate (3), a mechanism in which a high frequency is directly applied to the bumps (4) to vibrate the same can also be envisaged. It is desirable to select a vibrating mechanism which is most suitable for the circumstance.

In accordance with the present invention which comprises the above constituents, the bumps (4), (4), ... are urged downwardly to press against the pads (not shown) of the wafer chip. The state of contacts can then be visually ascertained from the central aperture (1) of the card substrate (2) through the transparent plate (3). If the pads do not contact uniformly with the bumps (4), (4), ..., adjustment can be made by the parallelism adjusting screws (7), (7), ... In this manner, after the pads have been made to uniformly contact with the bumps (4), (4), ... through the visual observation, a high-frequency vibration is applied to the vibration plate (8) and a test for electric characteristics can then be made. When the vibration plate (8) is vibrated, the vibration is transmitted to the transparent plate (3) itself and the bumps (4), (4), ... are vibrated thereby. Oxide layers formed over the surfaces of the contact pads are thereby subtly scratched away. This improves the electric conductivity and it is enabled to perform the test for electric characteristics more efficiently. Further, by creating the minute scratches, the state of contacts can be visually confirmed after the test.

<Effects of Invention>

As has been described above, in accordance with the present invention, instead of the

styluses, the bumps are provided on the transparent plate through printing and wiring. The contact pressure against the pads on the wafer chip in accordance with the present invention is only 4g/mm^2, which is drastically decreased from 12-20g/mm^2 in the case of the stylus mechanism, and substantial damages to the pads can thereby be obviated. Further, it is enabled to observe the state of contacts through the transparent plate, and adjustment of the contacts can be easily made by the parallelism adjusting screws. Moreover, because CAD for designing a LCI pad layout can be applied to the transparent plate, grounded circuits and dumps can be very finely made and, therefore, multi-pin structures can be sufficiently dealt with. Furthermore, by causing the bumps to vibrate through the vibration plate, the electric conductivity can be improved and the test for electric characteristics can be made more efficiently. Various other advantages are also apparent to those skilled in the art.

4. Brief Description of Drawings

Fig. 1 is a general side view of a probe card A in accordance with the present invention, Fig. 2 is a plan view of the same, Fig. 3 is an enlarged sectional view of the principal part of the present invention, Fig. 4 is an enlarged plan view of the principal part of the present invention and Figs. 5 and 6 are explanatory views of prior art examples.

(1) central aperture
(2) card substrate
(3) transparent plate
(4) bump
(5) auxiliary plate
(6) cushion member
(7) parallelism adjusting screw
(8) vibration plate

⑲日本国特許庁(JP)　⑪特許出願公開

⑫公開特許公報(A)　平3-65659

⑤Int. Cl.⁵	識別記号	庁内整理番号
G 01 R 1/073	E	6723-2G
31/26	J	8203-2G
H 01 L 21/66	B	7013-5F

⑬公開　平成3年(1991)3月20日

審査請求　有　請求項の数 1　(全5頁)

⑭発明の名称　プローブカード

⑳特　願　平1-202081
㉒出　願　平1(1989)8月2日

㉗発明者　坂東　悉二郎　福岡県粕屋郡粕屋町大字仲原2781番地　武田産業株式会社内
㉑出願人　武田産業株式会社　福岡県粕屋郡粕屋町大字仲原2781番地
㉔代理人　弁理士　有吉　教晴

明　細　書

1．発明の名称　プローブカード

2．特許請求の範囲

1．テスタに着脱自在なコネクタを備えたカード基板において、該カード基板の略中央に貫設される中心孔と、該中心孔を上記カード基板下面より覆設する絶縁体からなる透明板と、該透明板を中心孔に覆設する際に、上記カード基板との間に介在させる補助板及び転写ゴム等からなる接触用部材と、その先端が上記補助板に自在に圧接される如き上記中心孔周縁部に設けられる平行調整用ネジと、上記透明板下面に、ウェーハ・チップのパッドに対応する如く配線されるバンプとから構成され、更に上記バンプに振動を付与する手段を設けたことを特徴とするプローブカード．

3．発明の詳細な説明

＜産業上の利用分野＞

本発明は多ピン化される半導体チップの触針による電気的測定に替り、バンプによる接触により電気的測定を行うプローブカードに関するものである．

＜従来の技術＞

半導体製品の制作の際に導通状態などの電気的特性の測定が行われており、例えば半導体製品のウェーハ状態でのチェック、或いは抵抗アレイ、ダイオードアレイ、液晶の表示板などの各種ＩＣにおける電気的チェック等が行われいる．

この様な測定器として、各半導体製品毎に交換して使用するカード状のプローブカードが知られており、これは例えば、第5図に示されるように、カード基板aが、それと接続されるコネクタbによりテスタcに接続されている．

このカード基板aの中心部には複数の触針dが設けられ、この触針dの先端は下側に突出する構造となっている．

一方、半導体のウェーハ・チップeは可動台fの所定位置に載置されており、この可動台fを移動させてウェーハ・チップeを順次触針dの下側位置にセッティングする．そして、この触針dによりウェーハ・チップeの電気的測定が行われている．

上記カード基板aに取付けられる触針dは、第6図に示されるように、ウェーハ・チップeのパッド数に

応じて、カード基板aにエポキシ樹脂材等の絶縁体gによって取り付けられている。

<発明が解決しようとする課題>

しかし乍ら近年、液晶ＴＶ付ＶＴＲやワードプロセッサー等の普及により高密度集積回路（多ピン回路）の需要が増大している。そこでこれに対応する為には、触針の数を多くするしか無い。しかし上記触針の太さが200μm～250μmを有し、高密度に触針を並べるのに限界があり、又高密度になる程、触針は簡単に位置ずれが生じ易くなり、更に当たり、他の触針とショートする等の問題が生起し易くなる。しかもウェーハ・チップのパッドに触針の先端のみを接触させることで、その接触力の可減によっては、触針先端がパッドに突き刺って損傷を与える事も多々あるのが現状である。

本発明では上記諸問題を解消する為に、触針を使用せずに、グラス板等の絶縁板上に配置したバンプ群によって、ウェーハ・チップのパッドに接触させる機構としたプローブ・カードを提供することを目的とするものである。

<課題を解決する為の手段>

本発明の上記目的は次の如き構成のプローブ・カードによって達成できる。即ちその要旨はテスタに着脱自在なコネクタを備えたカード基板において、該カード基板の略中央に貫設される中心孔と、該中心孔を上記カード基板下面より覆設する絶縁体からなる透明板と、該透明板を中心孔に覆設する際に、上記カード基板との間に介在させる補助板及び転質ゴム等からなる緩衝用部材と、その先端が上記補助板に自在に圧接される如き上記中心孔周縁部に設けられる平行調整用ネジと、上記透明板下面に、ウェーハ・チップのパッドに対応する如く配線されるバンプとから構成され、更に上記バンプに振動を付与する手段を設けたことを特徴とするプローブカードである。

<実施例並びに作用>

以下本発明に係るプローブ・カードを、その実施例を示す図面を参酌し乍ら詳述する。

第１図は本発明のプローブ・カードＡの側面説明図、第２図は同平面説明図である。

即ちプローブ・カードＡは、その中央に中心孔(1)が貫設されるエポキシ樹脂等から成るカード基板(2)と、上記中心孔(1)を覆設する如く設けられる石英グラス等より成る透明板(3)と、同透明板(3)上面に、プリント配線化したバンプ(4)群から構成されるものである。そこで第３図に示すように、透明板(3)は、カード基板(2)下面に対して、補助板(5)及び転質ゴム等の緩衝用部材(6)を介して固着されるものである。そして上記補助板(5)上のカード基板(2)に、その先端が上記補助板(5)に当接する平行調整用ネジ(7)，(7)、…が、設けられるものであり、同平行調整用ネジ(7)を左右回転させることで、その先端が上記補助板(5)に当接され、その強弱によって、上記透明板(3)を上記緩衝用部材(6)を介して平行状に調整する機構とするものである。又上記中心孔(1)内内壁面上に、その先端が上記透明板(3)に当接する如き振動板(8)を設けるものである。

次に上記透明板(3)は、第４図に示すように、透明板(3)下面に薄膜ハイブリッドＩＣのプロセスを用いて、伝送路、電源回路用の電送路(9)，(9)…を形成する。この電送路(9)　(9)…先端上に、ウェーハ・チップのパッド位置と同位置上に、バンプ(4)　(4)　、…を突設するものである。このバンプ(4)は、通電性、かつ耐摩耗性の優れた材料で形成するものである。

更に上記透明板(3)に形成される電送路(9)の基端(10)には、カード基板基板(2)下面に配線されるパターン（図示せず）に一体的に接続されるものである。

なお上記透明板(3)の材質は、石英グラスの他に、ホワイトサファイヤ・グラス等のように硬質かつ絶縁性の優れた透明物質であればよく、できる限り薄板状に形成できる材質が望ましいものである。

なお上記振動板(8)に振動を付与し、透明板(3)を介してバンプ(4)に振動を与える機構の他に、バンプ(4)に直接に高周波を与え振動させる機構を考えられるものであり、状況に応じて最も適した振動機構を採用することが望ましいものである。

以上の構成より成る本発明では、ウェーハ・チップのパッド（図示せず）に対し、バンプ(4)、(4)、…を上方から押圧するように接触させるものであり、その際にカード基板(2)の中心孔(1)より、透明板(3)を通して、接地状態を観察する。そして上記パッドとバンプ(4)、(4)、…が一様に接触していない場合には、平行調整

用ネジ(7)、(7)、…によって、調整する。この様にして目視によってパッドとバンプ(4)、(4)、…を一様に接触させた後に、振動板(8)に対し高周波による振動を与えたら、電気特性試験を行うものであり、上記振動板(8)の振動によって、透明板(3)自体に振動が伝達され、バンプ(4)、(4)、…が振動する。従ってパッド面に形成される酸化皮膜に対し微妙な剥離が行われることで導電性が向上し、良好な電気特性試験を行うことが可能となる。又微少な傷を付けることで試験後に、目視による接触状況を確認することができるものである。

<発明の効果>

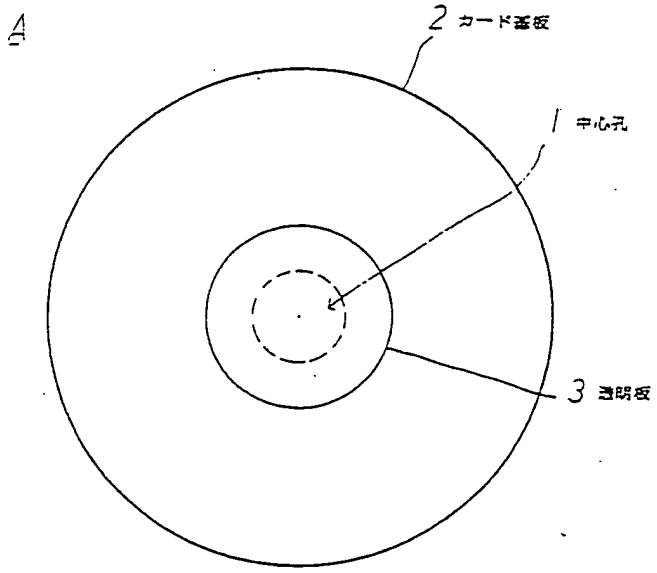
以上述べて来た如く本発明によれば、触針に替えて、透明板上にプリント配線化したバンプを設けることによって、ウェーハ・チップのパッドに対する接触圧が、触針機構の場合12～20g/mmに対し、本発明では4g/mm²と極端に小さくなり、パッドに損傷を与えることが殆ど無くなる。又透明板により接触状況が観察できると共に、平行調整用ネジによって簡単に接触調整が行われ、更に透明板に対し、ＬＣＩ設計のパッドレイアウトのＣＡＤを用いることができるために、接地回路及びダンプの微細化が可能となり、多ピン化への対応が充分に行なえるものである。しかも振動板によるバンプの振動を生起させることで導電特性を向上させ、よりよい電気特性試験を行なうことが可能となる等、種々の効果を奏するものである。

4．図面の簡単な説明

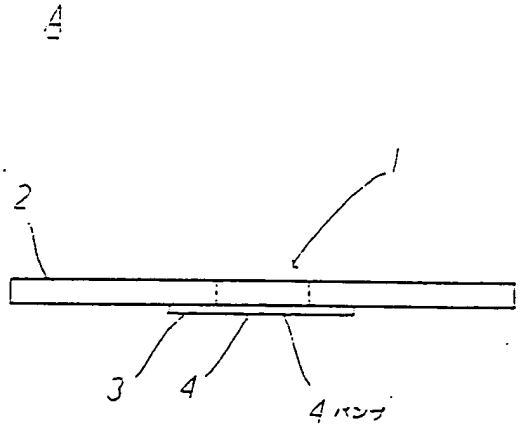
第１図は本発明のプローブ・カードＡの全体断面図、第２図は同平面図、第３図は本発明の要部拡大断面図、第４図は本発明の要部拡大平面図、第５図及び第６図は従来例を示す説明図である。

図中 (1) ： 中心孔
(2) ： カード基板
(3) ： 透明板
(4) ： バンプ
(5) ： 補助板
(6) ： 緩衝用部材
(7) ： 平行調整用ネジ
(8) ： 振動板

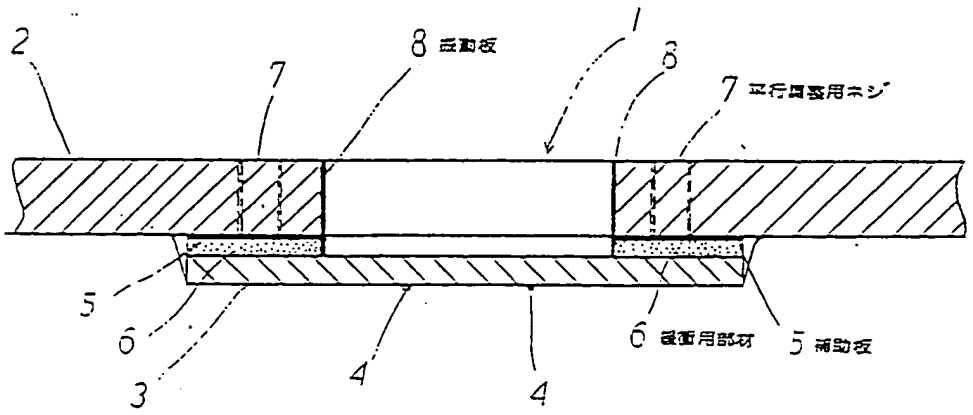
第１図



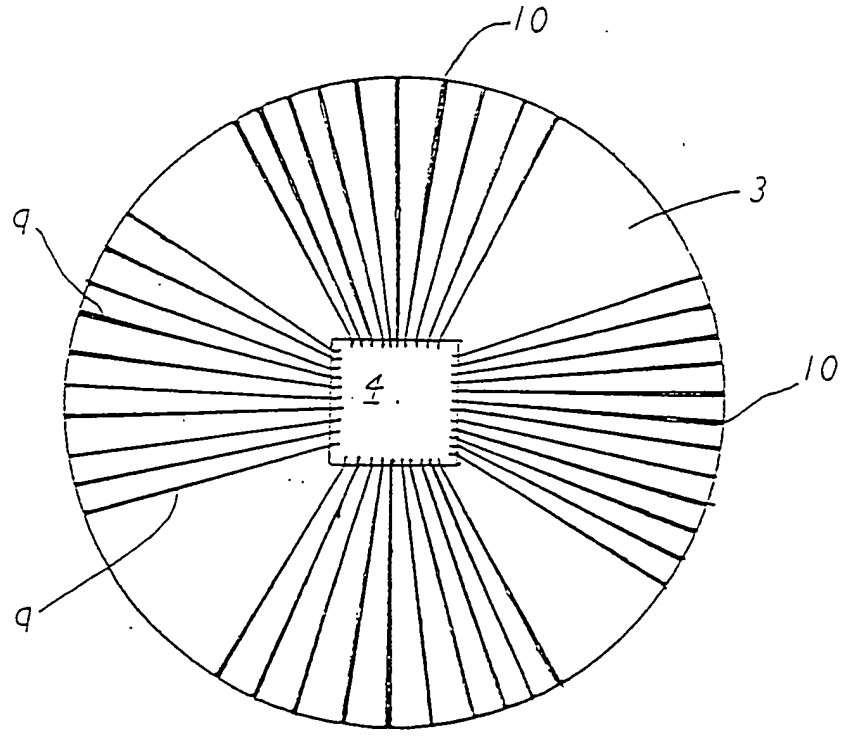
第２図



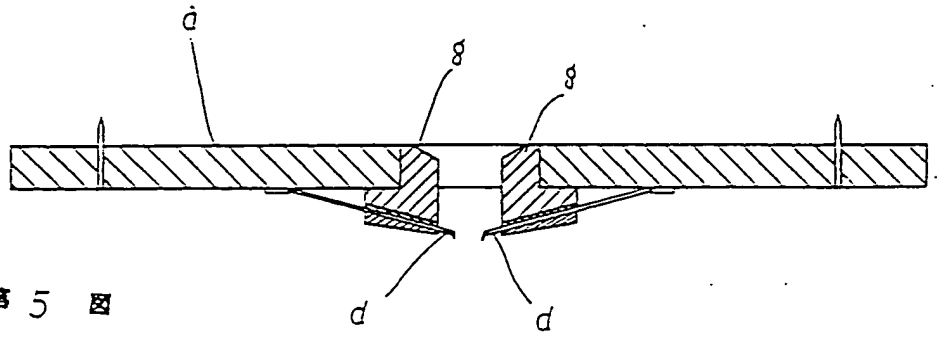
第 3 図



第 4 図



第 6 図



第 5 図